New, Experimental LAMP Lightning Probability and 'Potential' Forecasts

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The National Weather Service's Meteorological Development Laboratory has developed upgraded Localized Aviation MOS Program (LAMP) 2-h cloud-to-ground lightning strike probability and “potential” guidance forecasts for 20-km grid boxes in the 3- to 25-h time range over conterminous U. S. The LAMP lightning products are intended to support wildfire mitigation, electric power service, public safety, and other interests. The upgraded lightning forecasts, which have been produced in an experimental mode since June 2012, are expected to replace corresponding operational LAMP lightning probabilities and yes/no categorical forecasts during summer 2013. This article addresses the model upgrades, including derivation of the new lightning potential product, and forecast performance scores for the probabilities and potential. The upgrades are adopted from those in a new “sister” LAMP model that has been producing experimental convection probability and “potential” forecasts since April 2011 (an associated article appears in the 16th Conference on Aviation, Range, and Aerospace Meteorology).

One upgrade is an improved geographical regionalization method for the probabilities and potential, which prevents regional boundary discontinuities that occasionally appear in the operational LAMP lightning forecasts and permits more efficient computer processing. Another upgrade is predictor inclusion of “high resolution” MOS lightning probabilities based on the National Centers for Environmental Prediction (NCEP) North American Mesoscale Prediction System (NAM), which complements lower resolution NCEP Global-Forecast-System-based MOS lightning probability input used in both models.

The new “lightning potential” product consists of three levels of lightning threat (“low,” “medium,” and “high,” plus the “no” default), each of which is specified from the lightning probabilities by applying an objectively-derived probability exceedance threshold. The thresholding-categorization procedure maximizes the Critical Success Index (CSI) for low, medium, and high potential combined (a yes/no lightning re-categorization) subject to a bias constrained to be near 2.7 (for every 27 predicted events just 10 are observed, i.e., a low threshold probability results in a strong overforecast). Similarly, for medium and high potential combined, the prescribed bias is about 1.1 (about the same as with the operational yes/no lightning forecasts), and for high potential the bias is about 0.4 (a high threshold probability results in a strong underforecast). Thus, the bias for each potential level is fixed (“standardized”), whereas the threshold probabilities (along with the probability ranges) vary with forecast projection, geographical location, season, or time of day.

Comparative scoring of operational versus new lightning probabilities shows a clear improvement in Brier skill score with the latter, especially for forecast projections beyond about 6 hours. The new probabilities also show improved sharpness and geographical focus, which is seen from subjective examination of individual cases. Also, CSI scores for medium and high lightning potential combined are higher (better) than CSIs for the operational yes/no lightning forecasts. The improved forecast performance is attributed primarily to the supplemental predictor input from the NAM MOS probabilities.